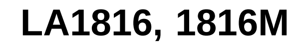
Ordering number: EN2659C

Monolithic Linear IC





Single-Chip AM/FM, MPX Tuner System for Headphone Stereos, Radio-Cassette Recorders

Functions

- FM: RF amplifier, MIX, OSC, IF amplifier, quadrature detector
- AM: RF amplifier, MIX, OSC, IF amplifier, detector, AGC
- MPX: PLL stereo decoder, stereo indicator, VCO stop

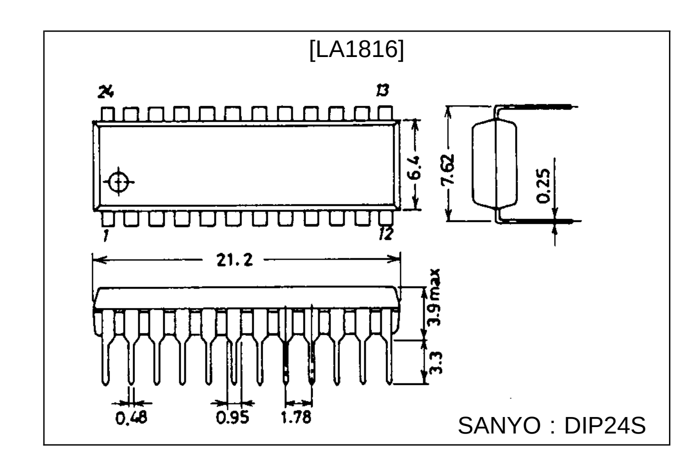
Features

- Contains FM tuner, AM tuner, MPX on a single chip.
- Adjustment-free FM detector and AM IF
- Minimum number of external parts required
- Low-voltage operation
- Low current drain
- Less carrier leak of MPX (no-input, monaural-input mode)

Package Dimensions

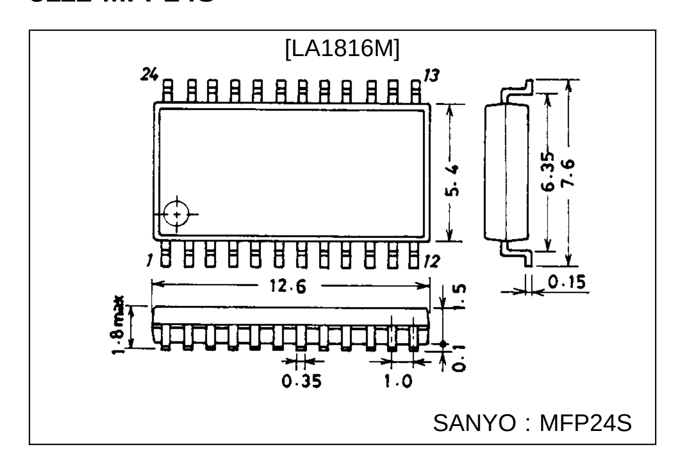
unit : mm

3067-DIP24S



unit : mm

3112-MFP24S



Specifications

Maximum Ratings at Ta = 25°C, See specified Test Circuit

Parameter	Symbol	Conditions	Ratings	Unit
Maximum supply voltage	V_{CC} max	Pins 8, 9, 11, 18, 20, 22	7	V
Maximum supply current	I_{CC} max	Pins 8 + 18 + 20 + 22	50	mA
Flow-in current (Indicator drive current)	I_{LED}	Pin 9	10	mA
Flow-out current	I_{21}	Pin 21	0.1	mA
Allowable power dissipation	Pd max	Ta ≦ 70°C	350	mW
Operating temperature	Topr		–20 to +70	°C
Storage temperature	Tstg		–40 to +125	°C

Operating Conditions at Ta = 25°C

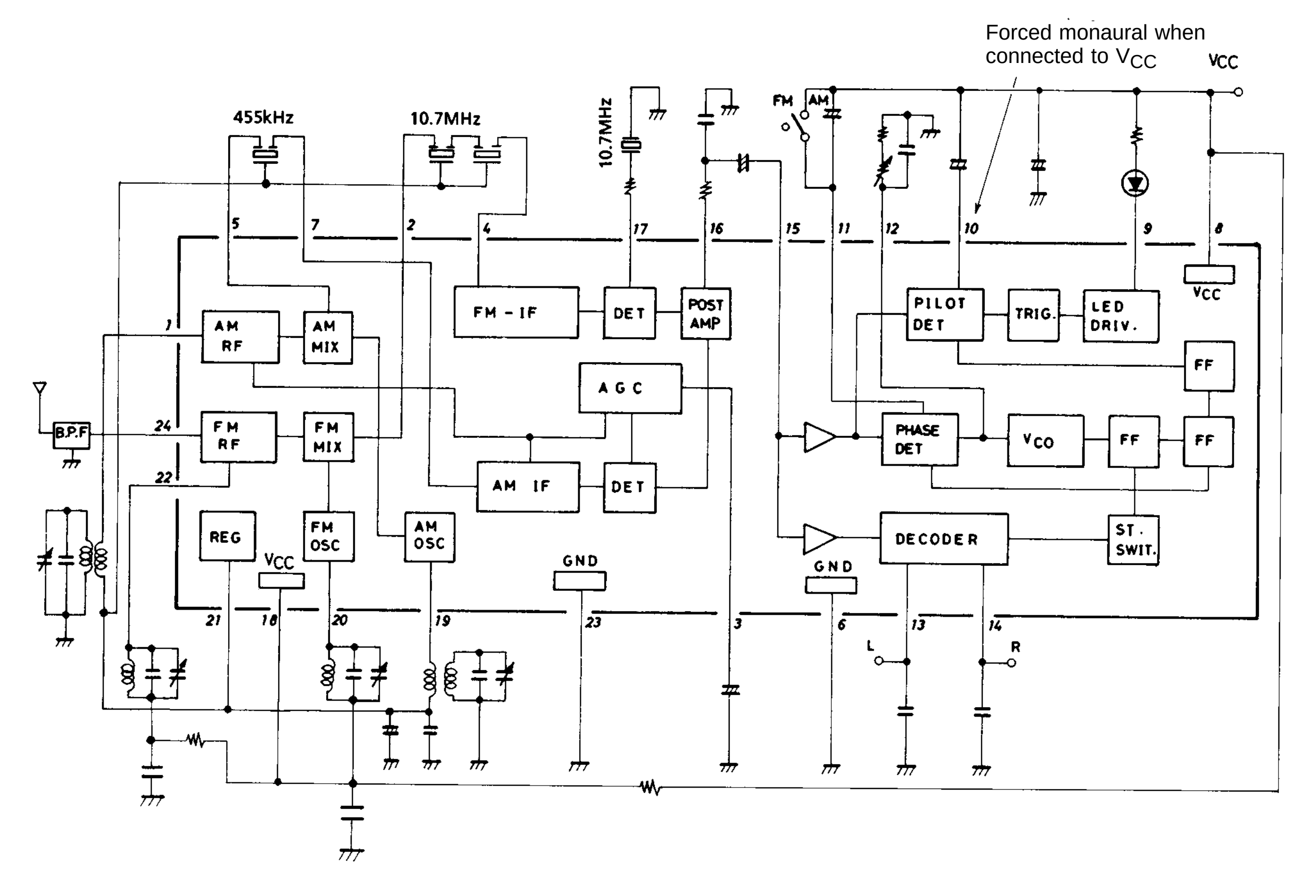
Parameter	Symbol	Conditions	Ratings	Unit
Recommended supply voltage	V_{CC}		3	V
Operating voltage range	V_{CC} op		1.8 to 6.0	V

Operating Characteristics at Ta = 25°C , V_{CC} = 3 V, See specified Test Circuit

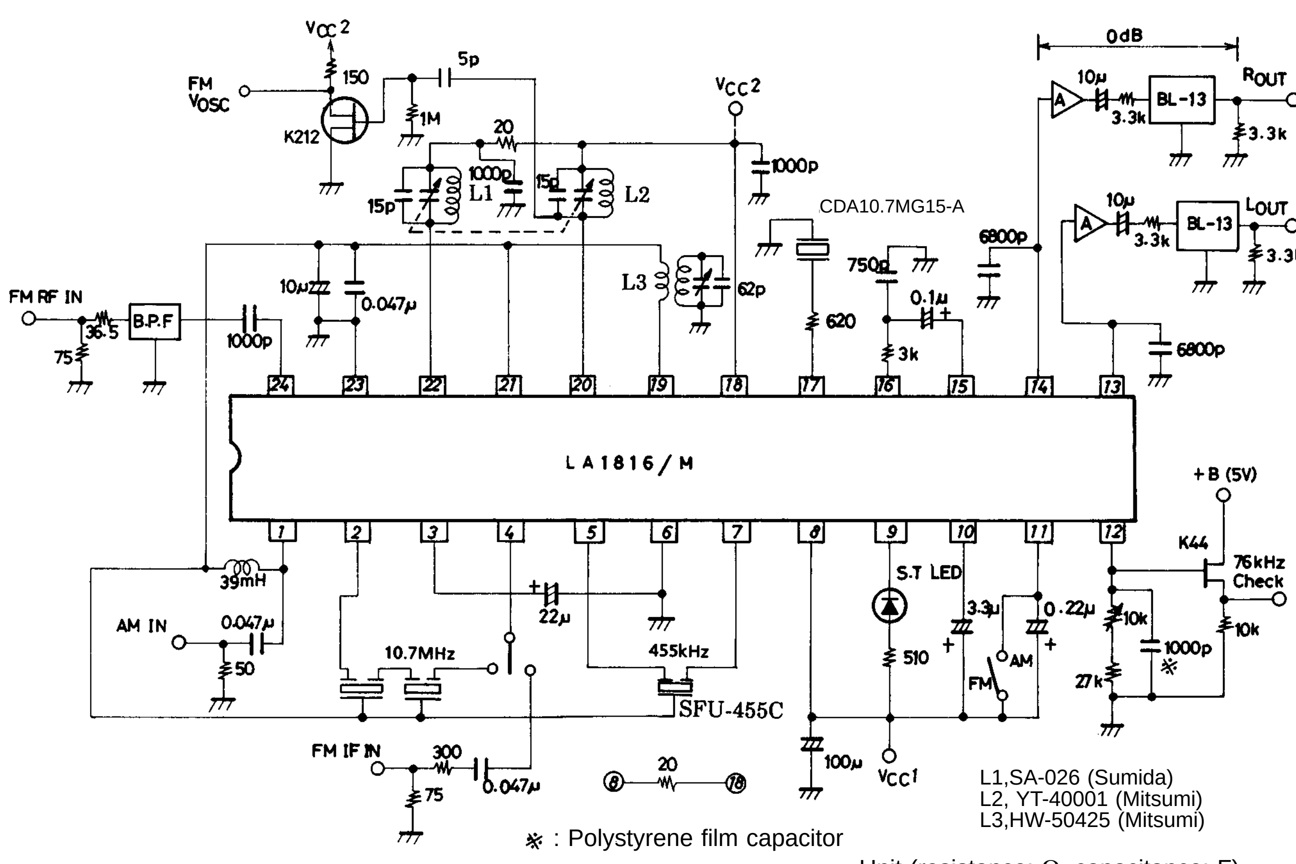
Parameter	Symbol	Conditions	min	typ	max	Unit
Quiescent current	I_{CCO} (FM)	FM mode V_{IN} = 0		8.9	15	mA
	I_{CCO} (AM)	AM mode V_{IN} = 0		3.3	5.5	mA
[AM Characteristics] : f_c = 1000 kHz, f_m = 1 kHz						
Detection output	V_O1	V_{IN} = 23 dBμ, 30% mod.	12	23	41	mV
	V_O2	V_{IN} = 80 dBμ, 30% mod.	48	74	120	mV
Signal to noise ratio	S/N1	V_{IN} = 23 dBμ, 30% mod.	16	21		dB
	S/N2	V_{IN} = 80 dBμ, 30% mod.	45	52		dB
Total harmonic distortion	THD1	V_{IN} = 80 dBμ, 30% mod.		0.3	1.3	%
	THD2	V_{IN} = 107 dBμ, 30% mod.		0.6	2.0	%
[FM Characteristics] (F.E.) : f_c = 98 MHz, f_m = 1 kHz						
–3 dB sensitivity	–3dBL.S.	Referenced to V_{IN} = 80 dBμ , 30% mod., 3 dB down		12		dBμ
Local oscillation voltage	V_{OSC}	f_{OSC} = 108.7 MHz	75	110	160	mV
[FM Characteristics] (IF + MPX, MONO) : f_c = 10.7 MHz, f_m = 1 kHz						
–3 dB sensitivity	–3dBL.S.	Referenced to V_{IN} = 100 dBμ, 100% mod., 3 dB down		39	46	dBμ
Demodulation output	V_O	V_{IN} = 100 dBμ, 100% mod.	100	135	200	mV
Channel balance	C.B.	V_{IN} = 100 dBμ, 100% mod.		0	2.0	dB
Total harmonic distortion	THD (mono)	V_{IN} = 100 dBμ, 100% mod.		0.7	3.0	%
Signal to noise ratio	S/N	V_{IN} = 100 dBμ, 100% mod.	70	75		dB
[FM Characteristics] (IF + MPX, STEREO) : f_c = 10.7 MHz, f_m = 1 kHz, L + R = 90%, pilot = 10%, V_{IN} = 100 dBμ						
Channel separation*	Sep		25	34		dB
Total harmonic distortion	THD (main)			0.6	2.5	%
LED-ON level	V_{LED-ON}		2.0	3.5	5.0	%
LED-OFF level	$V_{LED-OFF}$			2.7		%

* Sep = 45 dB (typ) at MPX IN

Equivalent Circuit Block Diagram



Test Circuit



L1,SA-026 (Sumida)
L2, YT-40001 (Mitsumi)
L3,HW-50425 (Mitsumi)

※ : Polystyrene film capacitor

Unit (resistance: Ω, capacitance: F)

Coil Specifications

FM

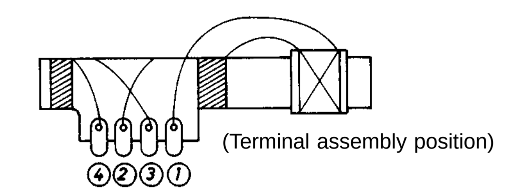
- ANT B.P.F
  SNY-074-2001 (Sumida)
- OSC
  YT-40001 (Mitsumi)
  5.5 mm ø air core, 0.8 mm wire, 3T
- RF SA-026(Sumida)
  3.5 mm ø air core, 1.0 mm wire, 5T
- Discriminator
  CDA 10.7MG (15) (Murata)

AM

- MW OSC
  HW-50425
  (Mitsumi)

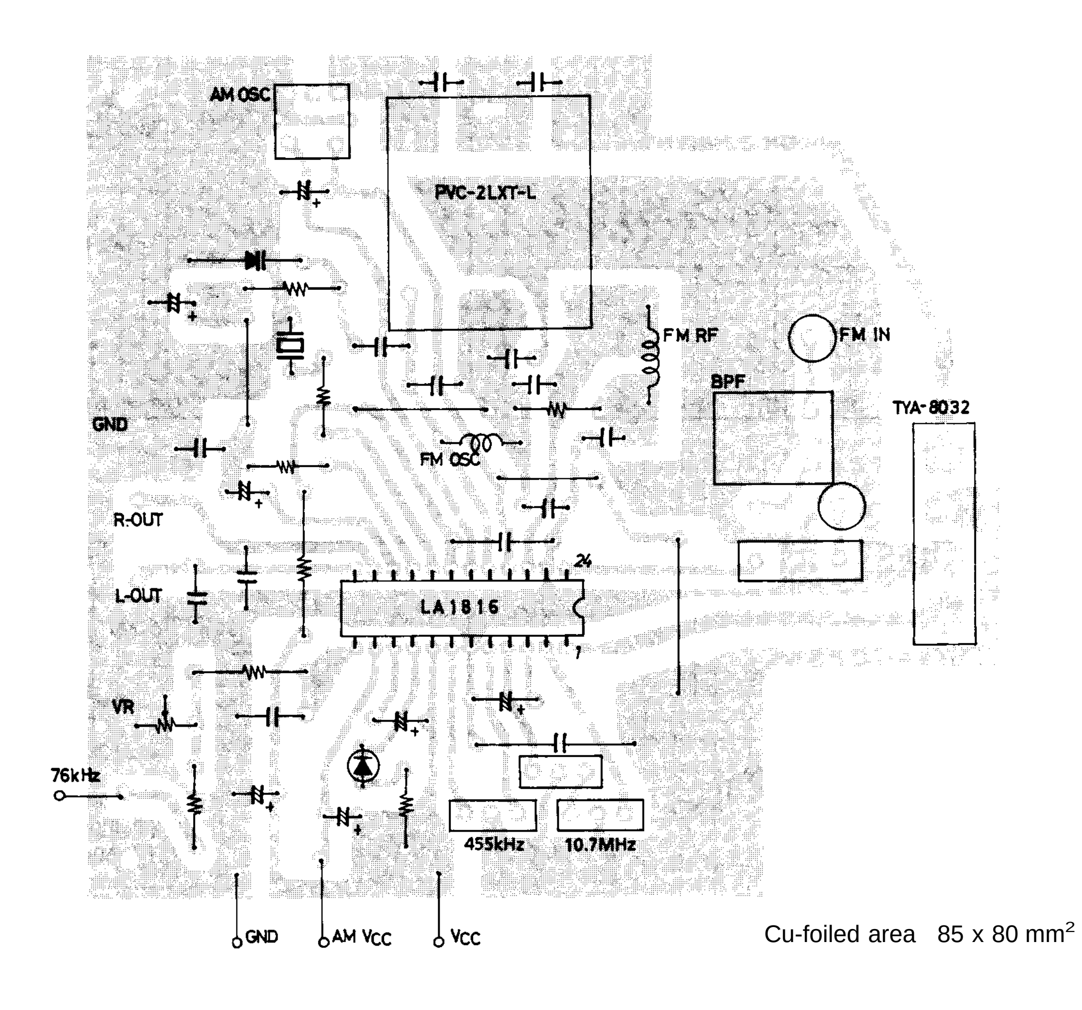
③ – ② 2T
④ – ⑥ 9T Qo ≧ 80
② – ① 86T L = 270 μH

- Bar antenna
  TYA-8032 (PVC-2LXT-L)
  (Mitsumi)



① – ② 21T • 100T
③ – ④ 30T
① – ② L = 604 μH
Qo ≧ 120

Sample Printed Circuit Pattern



Cu-foiled area 85 x 80 mm²

How to use the LA1816

1. VCO stop
   The VCO is stopped by shorting pin 10 and pin 8 (V_{CC} pin).
   Note) The maximum supply voltage on pin 10 must not exceed the voltage on pin 8.
2. Free-running frequency check
   Either of the following two methods is used to check the free-running frequency.
   (a) Connect pin 12 to a frequency counter through the high input impedance amplifier.

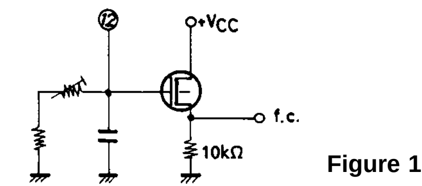


Figure 1

   (b) Connect the connection point of the semifixed resistor connected to pin 12 and the fixed resistor to a frequency counter through the resistor of 240 kΩ or greater.
   How the error changes with the resistor value is shown in Figure 2.

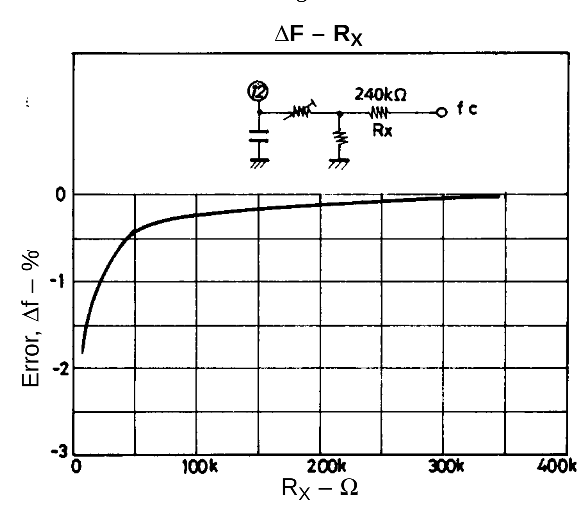


Figure 2

3. How to use the FM DET coil
   For pin 17 (FM DET), a coil may be used instead of adjustment-free FM discriminator.

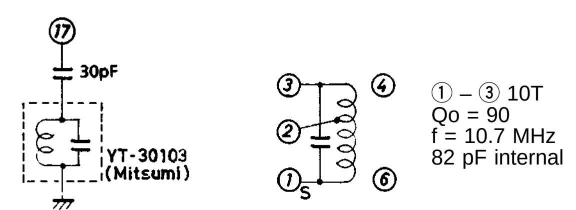
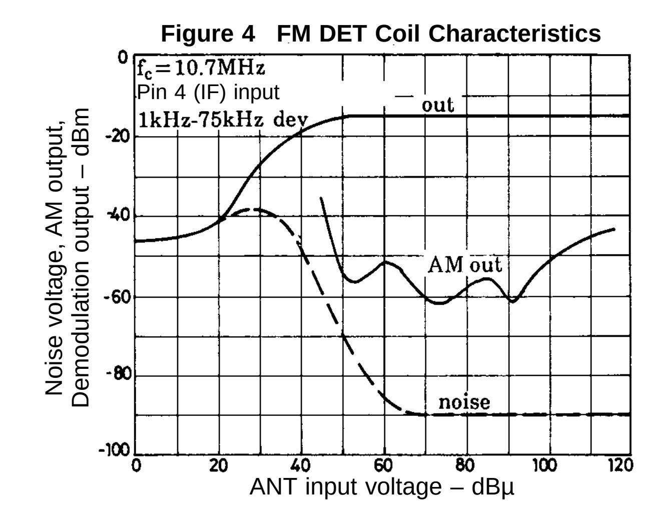
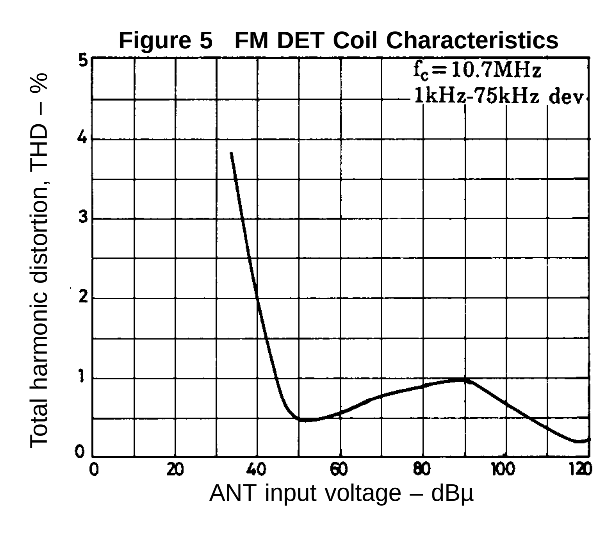


Figure 3 How to use the FM DET coil





4. How to use the FM AFC
   The S curve at output pin 16 is as shown Figure 6. Figure 7 shows how to provide FM AFC.

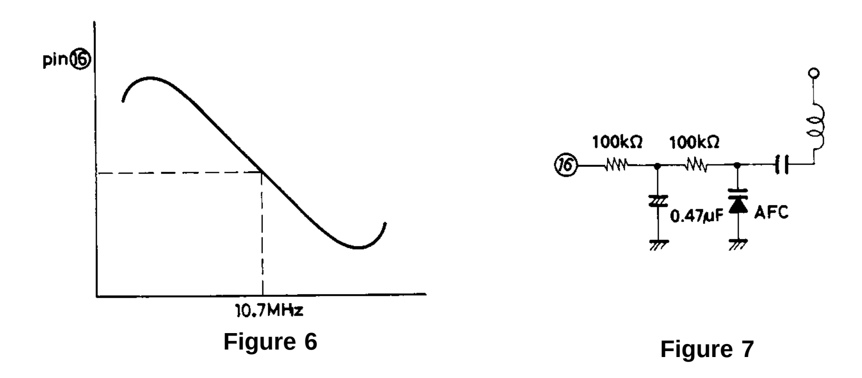


Figure 6

Figure 7

5. AM-FM selection
   The FM mode is entered with pin 11 open as shown in Figure 8 . When pin 11 and pin 8 are made to be at the same potential in terms of DC, the AM mode is entered. It should be noted that the dynamic range is narrowed whether the potential at pin 11 is lower or higher than that at pin 8.

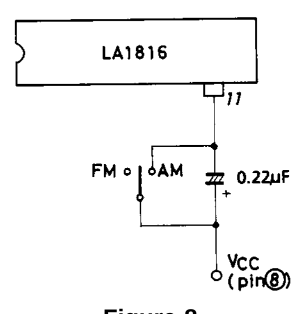
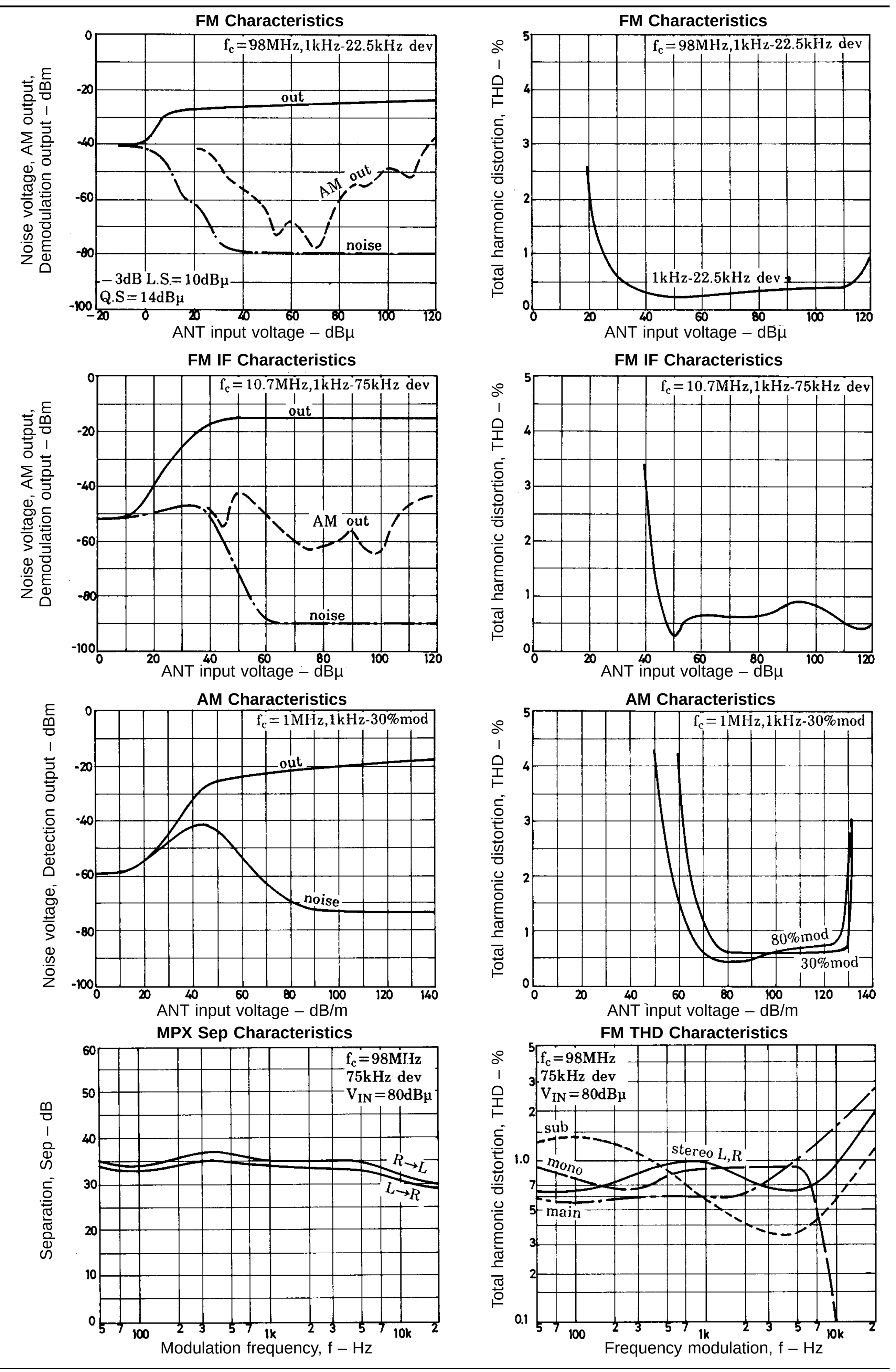
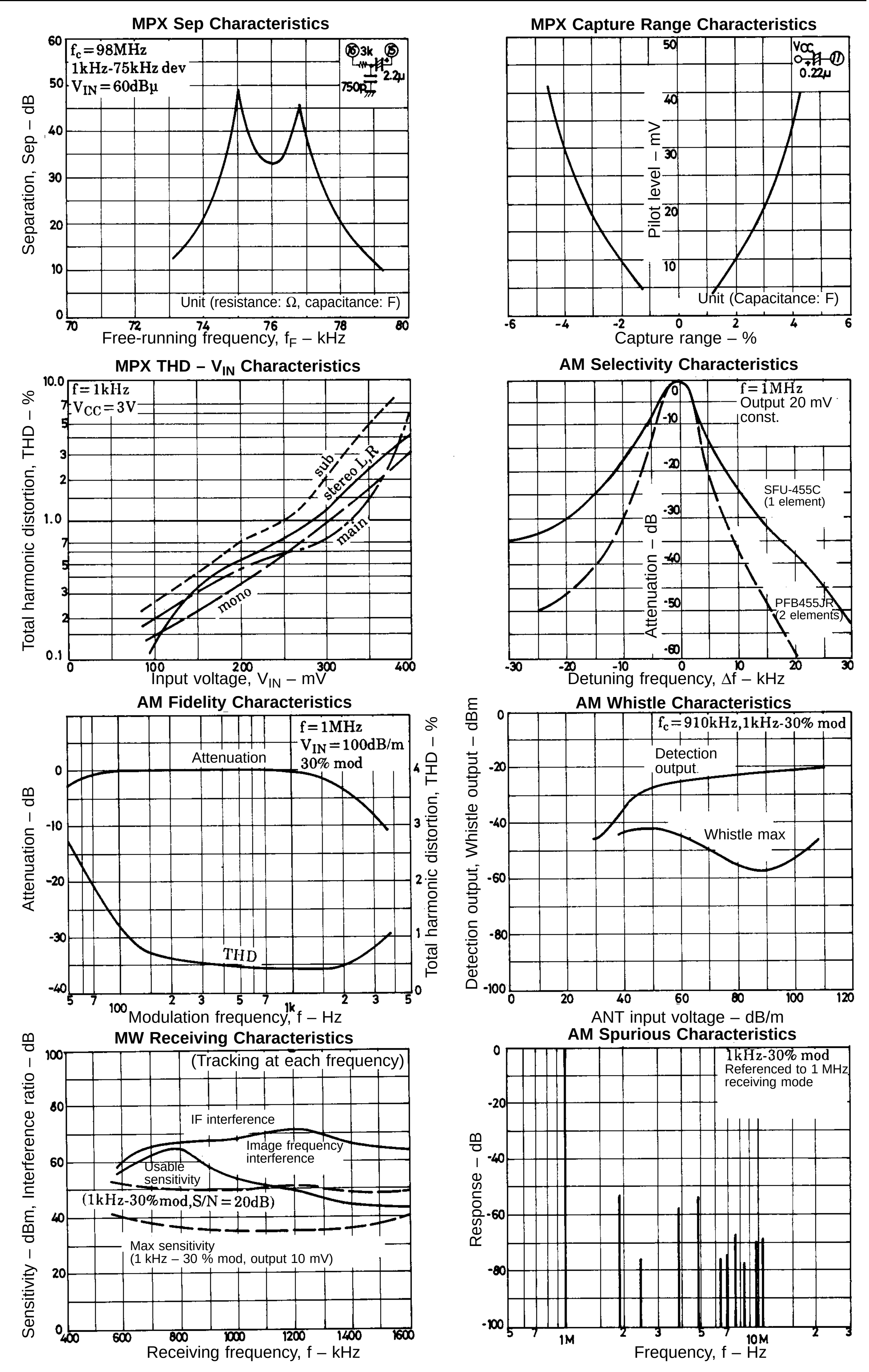
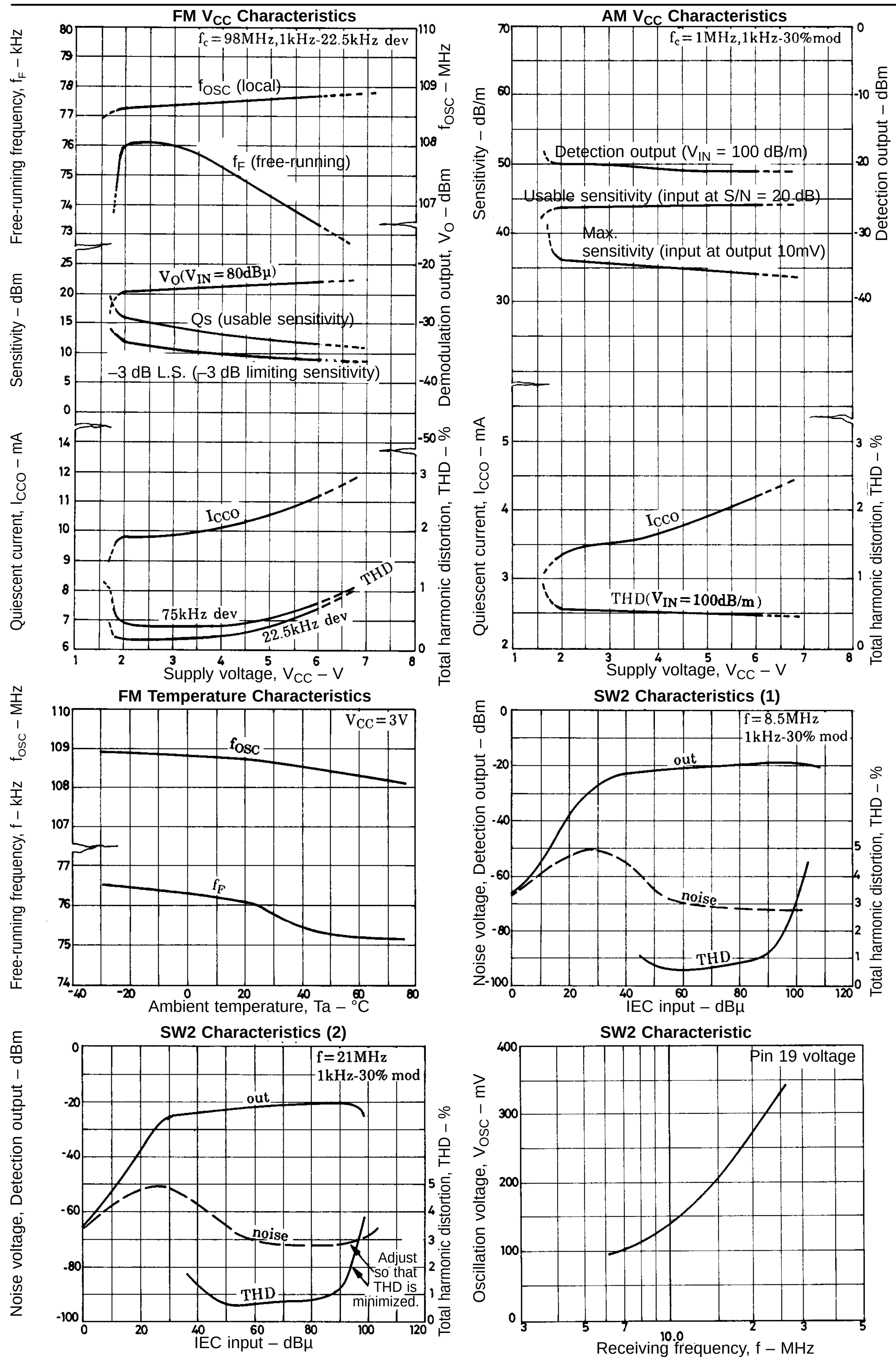


Figure 8

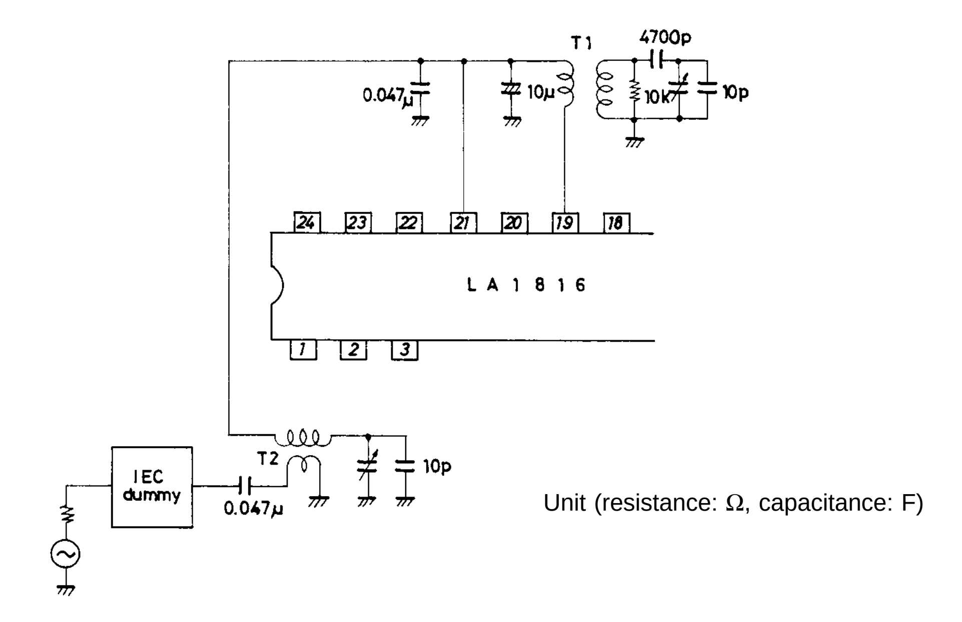


FM Characteristics
fc=98MHz,1kHz-22.5kHz dev
out
AM out
noise
-3dB L.S.=10dBμ
Q.S=14dBμ
Noise voltage, AM output, Demodulation output – dBm
ANT input voltage – dBμ
FM Characteristics
fc=98MHz,1kHz-22.5kHz dev
1kHz-22.5kHz dev
Total harmonic distortion, THD – %
ANT input voltage – dBμ
FM IF Characteristics
fc=10.7MHz,1kHz-75kHz dev
out
AM out
noise
Noise voltage, AM output, Demodulation output – dBm
ANT input voltage – dBμ
FM IF Characteristics
fc=10.7MHz,1kHz-75kHz dev
Total harmonic distortion, THD – %
ANT input voltage – dBμ
AM Characteristics
fc=1MHz,1kHz-30%mod
out
noise
Noise voltage, Detection output – dBm
ANT input voltage – dB/m
AM Characteristics
fc=1MHz,1kHz-30%mod
80%mod
30%mod
Total harmonic distortion, THD – %
ANT input voltage – dB/m
MPX Sep Characteristics
fc=98MHz
75kHz dev
VIN=80dBμ
R→L
L→R
Separation, Sep – dB
Modulation frequency, f – Hz
FM THD Characteristics
fc=98MHz
75kHz dev
VIN=80dBμ
sub
mono
stereo L,R
main
Total harmonic distortion, THD – %
Frequency modulation, f – Hz


MPX Sep Characteristics
f_c = 98MHz
1kHz-75kHz dev
V_{IN} = 60dBμ
Separation, Sep – dB
Free-running frequency, f_F – kHz
Unit (resistance: Ω, capacitance: F)
MPX Capture Range Characteristics
Pilot level – mV
Capture range – %
Unit (Capacitance: F)
MPX THD – V_{IN} Characteristics
f = 1kHz
V_{CC} = 3V
sub
stereo L,R
main
mono
Total harmonic distortion, THD – %
Input voltage, V_{IN} – mV
AM Selectivity Characteristics
f = 1MHz
Output 20 mV const.
SFU-455C (1 element)
PFB455JR (2 elements)
Attenuation – dB
Detuning frequency, Δf – kHz
AM Fidelity Characteristics
f = 1MHz
V_{IN} = 100dB/m
30% mod
Attenuation
THD
Attenuation – dB
Total harmonic distortion, THD – %
Modulation frequency, f – Hz
AM Whistle Characteristics
f_c = 910kHz, 1kHz-30% mod
Detection output
Whistle max
Detection output, Whistle output – dBm
ANT input voltage – dB/m
MW Receiving Characteristics
(Tracking at each frequency)
IF interference
Image frequency interference
Usable sensitivity
(1kHz-30%mod, S/N = 20dB)
Max sensitivity
(1 kHz – 30 % mod, output 10 mV)
Sensitivity – dBm, Interference ratio – dB
Receiving frequency, f – kHz
AM Spurious Characteristics
1kHz-30% mod
Referenced to 1 MHz receiving mode
Response – dB
Frequency, f – Hz

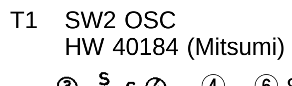

FM V_{CC} Characteristics
f_c = 98MHz, 1kHz-22.5kHz dev
f_{OSC} (local)
f_F (free-running)
$V_O(V_{IN}$ = 80dBμ)
Qs (usable sensitivity)
–3 dB L.S. (–3 dB limiting sensitivity)
I_{CCO}
THD
75kHz dev
22.5kHz dev
Free-running frequency, f_F – kHz
Sensitivity – dBm
Quiescent current, I_{CCO} – mA
f_{OSC} – MHz
Demodulation output, V_O – dBm
Total harmonic distortion, THD – %
Supply voltage, V_{CC} – V
AM V_{CC} Characteristics
f_c = 1MHz, 1kHz-30%mod
Detection output (V_{IN} = 100 dB/m)
Usable sensitivity (input at S/N = 20 dB)
Max. sensitivity (input at output 10mV)
I_{CCO}
THD(V_{IN} = 100dB/m)
Sensitivity – dB/m
Detection output – dBm
Quiescent current, I_{CCO} – mA
Total harmonic distortion, THD – %
Supply voltage, V_{CC} – V
FM Temperature Characteristics
V_{CC} = 3V
f_{OSC}
f_F
f_{OSC} – MHz
Free-running frequency, f – kHz
Ambient temperature, Ta – °C
SW2 Characteristics (1)
f = 8.5MHz
1kHz-30% mod
out
noise
THD
Noise voltage, Detection output – dBm
Total harmonic distortion, THD – %
IEC input – dBμ
SW2 Characteristics (2)
f = 21MHz
1kHz-30% mod
out
noise
THD
Adjust so that THD is minimized.
Noise voltage, Detection output – dBm
Total harmonic distortion, THD – %
IEC input – dBμ
SW2 Characteristic
Pin 19 voltage
Oscillation voltage, V_{OSC} – mV
Receiving frequency, f – MHz

SW Band Test Circuit

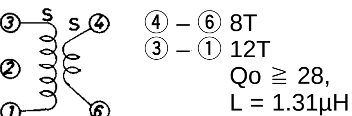


Unit (resistance: Ω, capacitance: F)

Coil Specifications

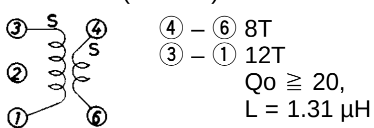


T1 SW2 OSC
HW 40184 (Mitsumi)



④ – ⑥ 8T
③ – ① 12T
Qo ≧ 28,
L = 1.31μH

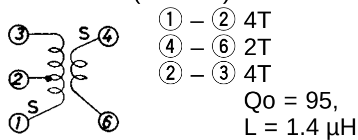
0237 1500 (Sumida)



④ – ⑥ 8T
③ – ① 12T
Qo ≧ 20,
L = 1.31 μH



T1 SW2 ANT
YT 30117 (Mitsumi)

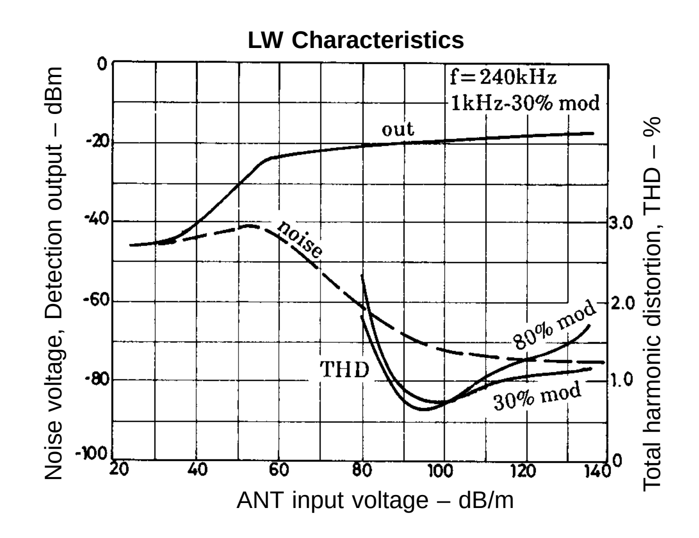


① – ② 4T
④ – ⑥ 2T
② – ③ 4T
Qo = 95,
L = 1.4 μH

2158 4095 319A (Sumida)

④ – ⑥ 2T
① – ② 5T
② – ③ 5T
Qo ≧ 40,
L = 1.4 μH

LW Characteristics

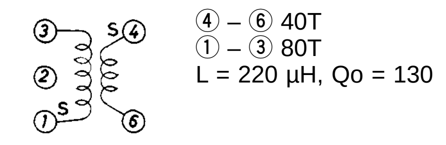


LW Band Test Circuit

Unit (capacitance: F)

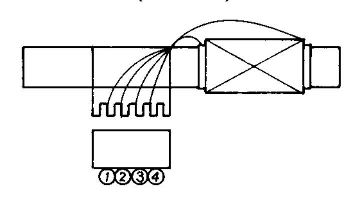
Coil Specifications

T1 • LW OSC
MA-7014 (Mitsumi)



④ – ⑥ 40T
① – ③ 80T
L = 220 µH, Qo = 130

L1 • LW bar antenna
HH-50161 (Mitsumi)



①– ② 20T
③– ④ 200T
③– ④ L = 2.74 mH, Qo ≧ 200